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EFFECT OF SOME AGRICULTURAL AND PHYSIOLOGICAL TREATMENTS ON GIZA 89 COTTON CULTIVAR

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ABSTRACT

Two field experiments were carried out in Gemmeiza Agric. Res. Station, in 1999 and 2000 seasons to study the effect of some agricultural and physiological treatments on growth, yield and yield components and fiber properties of cotton Giza 89 cultivar. The randomized complete block design with four replicates was used. The treatments were, 1- Control (untreated), 2- Pix application three times at the rate of 30 g.a.i/fed. at every spray , 3- Pix application once at the rate of 30 g.a.i/fed. with topping which was done after 100 days from sowing, 4- Topping alone after 100 days from sowing, 5- Foliar application of PK three times at the rate of (5 kg calcium superphosphate + 5 kg potassium sulphate)/fed. at every spray and 6- Uniconazole application three times at the rate of 400 g/fed. at every spray.

The results of the combined analysis were as following:

1- The short plants carrying the lowest number of fruiting branches were produced from plots receiving pix once with topping or pix three times alone or topping after 100 days from sowing alone without any significant differences among these treatments, while the taller plants were produced from untreated plants (control) or PK foliar application.

2- Boll weight, number of plants/fed. at harvest and lint % were insignificantly affected by the treatments under study.

3- Number of open bolls/plant, seed cotton yield/plant as well as per fed. were significantly affected by treatments, where the highest values of these traits were obtained from Uniconazole treated plants followed by pix treated plants once with topping or three times alone without any significant differences among these treatments, while the lowest values were obtained from topping alone, control and PK foliar application.

4- The results of fiber properties in 1999 season show that, fibre length was not affected by treatments under study, but micronaire value, fineness (millitex) and maturity percentage were affected significantly by treatments where the lowest values were obtained from control treatment and the highest values were obtained from topping alone or pix alone. Also, yarn strength was increased significantly by topping alone.

INTRODUCTION

Successful means to regulate the fruiting process in the cotton plant and to modify the cotton to retain more bolls and to control unwanted vegetative growth can be achieved by using some agricultural treatments i.e. topping or physiological treatments i.e. (1) plant growth retardants, i.e. Pix or Uniconazole or (2) foliar application with PK.

With regard to topping, Abdallah and Shalaby (1981) found that the highest seed cotton yield/fed. and seed index were obtained by plants topped on July 5. El-Hanafi *et al*. (1982) reported that the highest seed cotton yield and lint cotton resulted from the plants topped on June 15 – 20 and August 1 –5. Also, they mentioned that early June topping gave heavier bolls and

seeds. Ghaly *et al*. (1988) stated that cotton plants topped at 105 days age 13 August, gave the highest values for number of fruiting branches/plant, number of open bolls/plant, seed cotton yield/plant and per feddan, lint % and seed index, while the heavier bolls were obtained from plants topped at 90 days age. Wassel (1990) found that the topping significantly decreased cotton plant height and number of fruiting branches/plant, while seed index and lint % were not affected by toping. Rahman *et al*. (1991) reported that topping increased seed cotton yield and boll number per plant, but did not affect boll weight.

Concerning the effect of pix (mepiquat chloride or 1,1-dimethyl piperidinum chloride), Malik *et al.* (1988), Reddy *et al*. (1990), (1992), Fatma (1994) and El-Shahawy (1999) found that pix application resulted in a significant reduction in both plant height and internode length. El-Shahawy (1999) found that pix application increased the number of sympodia, number of open bolls, boll weight, lint %, seed index and seed cotton yield.

With respect to Uniconazole ISO proposed [(E)–1–(P-chlorophenyl)–4,4- dimethyl–2–(1,2,4-triazol-1-yl)–1–penten–3–ol], it is used as a GA synthesis inhibitor where, Uniconazole, reaching sub apical meristems, inhibits gibberellic acids (GA) biosynthesis by blocking the oxidative reactions of kaurene to kaurenoic acid and this causes the suppression of cell elongation and the direct morphological consequent is reduction in vegetative growth (Sumitomo Chemical Co.).

Concerning PK foliar application, Krishnan *et al*. (1994) found that 2 foliar sprays of 10 kg K_2O/ha gave the highest seed cotton yield. El-Sayed (1996) found that three foliar sprayings of phosphorus at 75, 90 or 105 days from sowing increased boll set, number of open bolls and seed cotton yield.

MATERIALS AND METHODS

Two field experiments were carried out at Gemmeiza Agricultural Research Station during 1999 and 2000 seasons, to study the effect of two cotton growth retardents, i.e. Pix and Uniconazole, topping, pix with topping and foliar application of (5 kg calcium superphosphate + 5 kg potassium sulphate) /fed. The treatments were evaluated with regard to the physiological processes in the plant and their effects on plant growth, yield and yield components of the Egyptian cotton cultivar Giza 89 (*G. barbadense* L.) in comparison with control treatment.

The experimental design used was a randomized complete blocks with four replicates.

The treatments were as follows:-

1- Control, sprayed with the same amount of water at the application times of foliar application of other treatments.
2- Foliar application of Pix (mepiquat chloride) three times at the beginning of squaring, flowering and 15 days later at the rate of 30 g.a.i/fed. at every spray.
3- Topping after 100 days from sowing, beside application of pix at the rate of 30 g.a.i./fed. once at the beginning of flowering.

4- Topping after 100 days from sowing by hand picking of the tips of the main stem and vegetative branches.

5- Foliar application of PK three times at the beginning of squaring, flowering and 15 days later at the rate of (5 kg potassium sulphate+5 kg superphosphate)/fed. at every spray.

6- Foliar application of Uniconazole (0.04% G) [(E)–1–(P-chlorophenyl)–4,4- dimethyl–2–(1,2,4-triazol-1-yl)–1–penten–3–ol] three times, at the beginning of squaring, flowering and 15 days later at the rate of 400 g/fed. at every spray.

In the first season, the plot size was 19.5 m^2 (5 m x 3.9 m) including 6 rows. While, in the second season it was 20.475 m^2 (4.5 m x 4.55 m) including 7 rows. The row was 65 cm wide with hills 25 cm. apart. The two outer rows of each plot were used as belt.

Sowing dates were 21/3 and 28/3 for the first and second seasons, respectively.

Phosphorus fertilizer was applied at the rate of 22.5 kg P_2O_5/fed. as calcium superphosphate (15% P_2O_5) during land preparation. Nitrogen fertilizer was applied as ammonium nitrate (33.5% N) at a rate of 60 kg N/fed. splitted into two equal portions. The 1st portion was applied after thinning and the 2nd portion was applied 15 days later. Potassium fertilizer was added at the rate of 24 kg K_2O/fed. as potassium sulphate (48% K_2O) in one dose at the time of applying the 1st dose of N.

Other cultural practices were carried out as recommended for the conventional cotton planting.

Soil analysis for the two sites was done according to the procedures described by Jackson (1960). The results are shown in Table 1.

Table (1): Mechanical and chemical analysis of the experiment site.

Mechanical analysis			Chemical analysis		
	1999	2000		1999	2000
Clay %	59.3	55.4	Avail N (ppm)	19.1	31.2
Silt %	26.1	28.5	Avail P (ppm)	14.8	13.5
Sand %	14.1	15.9	Avail K (ppm)	620	610
$CaCO_3$ %	3.1	2.7	pH	8.1	8.0
Texture	Clay loam	Clay loam	EC mmohs cm^{-1}	1.2	1.1

In both seasons, five representative hills from the inner ridges of each plot were taken at random at the end of the season to estimate the following characters: final plant height (cm.), number of fruiting branches/plant, number of open bolls/plant, boll weight (g.), seed cotton yield/plant (g.), lint % and seed index (g.). Seed cotton yield/fed. in kentars and plant population at harvest time (thousand/fed.) were calculated from the inner rows of each plot.

In 1999 season, 2.5 and 50% fiber span lengths (S.L.) in mm. were measured by the Fibrograph 530. Staple uniformity ratio is expressed as 50% Span Length x 100/2.5% span length. Fiber maturity, micronaire value and fiber fineness in terms of (10^{-8} g/cm.) were determined by the 11C-Shirley Fineness/Maturity Tester (F/M-T). Yarn strength quoted in the product of Lea strength in pounds x yarn count (60's carded). These characters were

determined at the fibers technology laboratory at Cotton Res. Inst., Giza according to ASTM (1967).

The data obtained were subjected to statistical analysis by the procedure outlined by Gomez and Gomez (1984). The treatment means were compared using the New Least Significant Difference (NLSD) test at 0.05 as outlined by Waller and Duncan (1969). Collected data for traits under study except fiber properties were combined statistically analysed using the procedures outlined by Freund and Littell (1981).

RESULTS

Growth traits:

Combined data presented in Table (2) indicate that treatments gave significant effect on plant height at harvest and number of fruiting branches/plant, where the taller plants were produced from untreated plants and plants receiving PK foliar application followed by Uniconazole treated plants, while the shorter plants carrying the lowest number of fruiting branches resulted from plants receiving pix with topping or pix alone or topping alone without any significant differences among these three later treatments. Uniconazole treated plants gave the highest number of fruiting branches followed by PK foliar treatment and control without any significant differences among these three treatments.

Seed cotton yield/fed. and its components:

Results in Tables 2 and 3 (combined of the two seasons) show that boll weight, number of plants/fed. and lint % were insignificantly affected by these treatments, but seed index was significantly affected by these treatments where the highest value was obtained from topping alone and the lowest value was obtained from Uniconazole treated plants.

The combined data presented in Tables 2 and 3 show that number of open bolls/plant, seed cotton yield/plant as well as per feddan were significantly affected by treatments, where the highest values of these traits were obtained from Uniconazole treated plants or pix treated plants once with topping or alone three times without any significant differences among these three treatments, while the lowest values were obtained from topping alone, control and PK foliar application in a descendingly order.

Fiber properties:

Fiber length did not affect by treatments in 1999 season (Table 4). While, micronaore value, fineness (millitex) and maturity percentage were affected significantly by treatments where the lowest values of these traits were obtained from control followed by three foliar applications of PK but the highest values were obtained from topping alone or three times of pix applications at the rate 30 g.a.i./fed.

Yarn strength was affected significantly by treatments, in favour of topping treatment.

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DISCUSSION

Effect of Pix:

The reduction in plant height due to pix application is mainly due to reduction of internode length. In this concern, Reddy *et al*. (1990) and Fatma (1994) reported that pix reduced plant height, number of main stem nodes and internode length and this reduction might be due to the inhibitory effect of pix on the synthesis of gibberellins which have a role in cell division and cell expansion, Girgis (1993) found that pix was effective in limiting plant height significantly by any rate or time of application and he attributed this effect to that auxin may catalyze the hardening of the cell wall thus leading to a shorter cell duration growth and a shorter final cell wall length. Mahmoud *et al*. (1994-b) found that pix application caused a significant decrease in gibberellin and auxin activities, especially if sprayed 94 days after sowing, with the effect increasing with increasing application rates. Pix application resulted in a significant reduction in plant height compared with untreated control plants, Abdel-Al *et al*. (1986), Etidal *et al*. (1986), Makram (1988), Azab *et al*. (1993), Livingston and Parker (1994), Gwathmey *et al*. (1995), Hickey (1995), Rodriguez and Gutierrez (1995), Shumway (1995) and El-Shahawy and Abd El-Malik (2000). Robertson and Cothren (1995) found that plots receiving any MC treatments had shorter plants (21%) and shorter internodes (17%) compared with the control where, MC acts to inhibit the synthesis of gibberellin acid. Ibrahim and Moftah (1997) reported that the ability of MC to counteract the apical dominance which could be due to the reduction in auxin transport to bud sites caused by increasing cytokinin concentration which restricted transport of auxin to axillary buds and subsequent but out growth has been demonstrated for cotton. Ghourab *et al*. (2000) reported that the application of mepiquat chloride reduced plant height and length of inter-nodes.

The increment in seed cotton yield of pix-treated plant than pix-untreated one was mainly due to the higher number of open bolls/plant which may be due to increasing boll retention/plant. In this concern, pix increased number of open bolls and seed cotton yield/plant, Makram (1988), Abdel-Al (1998) and El-Shahawy (1999). Ibrahim and Moftah (1997) reported that the increase in number of total bolls/plant may result from increasing the percentage of boll retention/plant, where MC acting as a reducer to abscisic acid and a stimulator to IAA and cytokinin. El-Shahawy (1999) reported that pix acts as a reducer to abscisic acid and ethylene hormones which in turn increases boll retention and consequently more open and heavier bolls.

Lint %, seed index and boll weight were less affected by pix application. In this concern, Girgis (1993), Boman and Westerman (1994) and Ghourab *et al*. (2000) found that lint % was not affected by MC. Abdel-Al *et al*. (1986), Girgis (1993) and Ghourab *et al*. (2000) found that seed index did not affect by spraying pix. Abdel-Al *et al*. (1986) and Abdel-Al (1998) found that MC had no effect on boll weight.

The increment in seed cotton yield/fed. due to pix application was mainly attributed to the higher number of open bolls/plant and consequently yield/plant which is considered one of the major yield/area components. In this respect, Makram (1988) found that the dose of 50 – 100 g.a.i./ha

increased yield/ha. Malik *et al*. (1988), Azab *et al*. (1993) found that seed cotton yield only increased with application of 100 ppm mepiquat chloride at first flower stage. Girgis (1993) found that application of pix at any rate or time increased significantly yield. Abdel-Al (1998) found that seed cotton yield/fed. was increased by pix application but the increase was significant only by the treatment of 500 ml/fed. once at the beginning of flowering stage. El-Shahawy and Abd El-Malik (2000) reported that spraying pix resulted in increasing seed cotton yield/fed. Ghourab *et al*. (2000) found that lint micronaire reading was not significantly affected by pix application.

Effect of topping:-

Topping cotton plants after 100 days from sowing at a certain height i.e. 116 and 122.4 in 1999 and 2000 seasons, respectively decreased plant height up to this limit of growth with lower number of fruiting branches/plant. In this concern, topping significantly decreased cotton plant height and number of fruiting branches/plant, Abdallah and Shalaby (1981) and Wassel (1990).

The insignificant increase in seed cotton yield due to topping plant as compared with untreated one is mainly due to that removing the apical bud of the cotton plant especially earlier in the season resulted in lower number of fruiting branches/plant carrying similar number of open bolls compared with untreated plant and heavier bolls. Lint % and boll weight were insignificantly affected by topping while seed index was significantly increased by topping as compared with other treatments. In this respect, boll weight was insignificantly affected by topping, El-Ganayni *et al*. (1984), Rahman *et al*. (1991) and Abd El-Malik and El-Shahawy (1999). Kittock and Fry (1977) and Wassel (1990) found that lint percentage and seed index were not affected by topping Rahman *et al*. (1991) reported that topping increased seed cotton yield and boll number per plant.

The insignificant increase in seed cotton yield/fed. due to topping as compared with untreated is mainly attributed to the lower number of fruiting branches/plant which carrying bolls similar to that of untreated plants. In this concern, Ghaly *et al*. (1988) reported that cotton plants topped at 105 days age (13 August) gave the highest value of seed cotton yield/fed.

Effect of pix and topping:-

This treatment gave the shorter plants carrying the lower number of fruiting points as compared with control or other treatments.

The higher number of open bolls/plant due to this treatment as compared with other treatments may be due to the positive effects of both topping and pix on cotton plants where, MC acting as a reducer to abscisic acid and a stimulator to IAA and cytokinin and this led to increase of the percentage of boll retention/plant (Ibrahim and Moftah, 1997), beside this effect, topping stimulated the lateral branches to grow and consequently increased the boll sets on these branches (Abd El-Aal *et al*., 1996). Previous finding of Kittock and Fry (1977) may support our present result since they found that topping increased boll set on top fruiting branches and resulted in additional branch nodes on top fruiting branches. Plants topped 17 July

produced 300%, 100% and 60% more bolls on the first, second and third branch, respectively, below the point of topping than did the check plants.

Effect of foliar application of PK:-

The negative effect on seed cotton yield/plant and its components and seed cotton yield/fed. due to foliar application of (5 kg calcium superphosphate + 5 kg potassium sulphate)/fed. as compared with control or other treatments might be due to the relative high contents of available phosphorus and potassium in the experimental soil (Table 1). Knowles *et al*. (1994), found that foliar K application did not significantly increase fibre strength of the 10 cotton cultivars tested compared with unfertilized plots.

Effect of Uniconazole:-

The effect of Uniconazole on plant height is mainly due to that Uniconazole reaching sub-apical meristems, inhibits gibberellic acids (GA) biosynthesis by blocking the oxydative reactions of kaurene to kaurenoic acid and this causes the suppression of cell elongation and the direct morphological consequent is reduction in vegetative growth.

The increment of number of fruiting branches/plant due to Uniconazole indicated that the significant decrease in plant height is mainly due to internode length and not to number of the main stem internodes.

The positive effect of Uniconazole on seed cotton yield/fed. and its components as compared with other treatments, may be due to the following as confirmed by this study:-

1) It decreased the internode length and increased main stem nodes which confirmed by the higher number of fruiting branches/plant.
2) It increased the boll sets on the fruiting branches/plant.
3) Heavier bolls and higher lint % which were obtained from this treatment.
4) Higher seed cotton yield/plant as compared with other treatments.

CONCLUSION

From these results it could be concluded that using cotton growth retardents, i.e. pix or Uniconazole as well as using pix in addition to toping could be used as successful means to regulate the processes in the cotton plant and consequently increased seed cotton yield/fed. and its components.

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تأثير بعض المعاملات الزراعية والفسيولوجية على صنف القطن جيزة ٨٩

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أجريت تجربتان حقلتيان بمحطة البحوث الزراعية بالجميزة خلال موسمى ١٩٩٩ و٢٠٠٠م لدراسة تأثير بعض المعاملات الزراعية والفسيولوجية على النمو والمحصول ومكوناته وصفات التيلة لصنف القطن جيزة ٨٩، واستخدم تصميم القطاعات الكاملة العشوائية فى أربعة مكررات٠ وكانت المعاملات:

1- مقارنة (بدون معاملة)
2- رش منظم النمو بكس ثلاث رشات بمعدل ٣٠ جم مادة فعالة/فدان لكل رشة٠
3- رش منظم النمو بكس رشة واحدة بمعدل ٣٠ جم مادة فعالة/فدان مع إجراء عملية التطويش عند عمر ١٠٠ يوم من الزراعة.
4- إجراء التطويش فقط بعد عمر ١٠٠ يوم من الزراعة.
5- الرش ثلاث مرات بمنقوع (٥ كجم سوبر فوسفات الكالسيوم + ٥ كجم سلفات بوتاسيوم للفدان) لكل رشة.
6- الرش بمؤخر النمو يونيكونازول ثلاث مرات بمعدل ٤٠٠ جم/فدان لكل رشة.

وكانت نتائج التحليل المشترك كما يلى:-

1- أعطت القطع التى رشت بمنظم النمو بكس مرة واحدة مع التطويش، وتلك التى رشت بالبكس ثلاث مرات فقط أو تم تطويشها فقط بعد ١٠٠ يوم من الزراعة أقصر النباتات والتى تحمل أقل عدد من الأفرع الثمرية ولم توجد فروق معنوية بين هذه المعاملات الثلاث بينما أعطت القطع الغير معاملة (الكنترول) أطول النباتات.
2- لم تتأثر معنويا صفات وزن اللوزة وعدد النباتات للفدان عند الجنى وتصافى الحليج بالمعاملات تحت الدراسة.
3- تأثرت معنويا صفات عدد اللوز المتفتح على النبات ومحصول القطن الزهر للنبات وكذلك للفدان بالمعاملات حيث تم الحصول على أعلى القيم لهذه الصفات الثلاث من النباتات المعاملة باليوننكونازول يليها النباتات المعاملة بالبكس مرة واحدة مع التطويش أو ثلاث مرات فقط بدون أى فروق معنوية بين هذه المعاملات الثلاث بينما أقل القيم تم الحصول عليها من اجراء التطويش فقط، معاملة المقارنة، والرش بالفوسفور والبوتاسيوم٠
4- لم تتأثر صفة طول التيلة بالمعاملات تحت الدراسة بينما تأثرت صفات قيمة الميكرونير، النعومة (مللى تكس)، النسبة المئوية للنضج معنويا بالمعاملات تحت الدراسة وأعطت معاملة المقارنة أقل القيم لهذه الصفات ، بينما أعطى التطويش فقط أو الرش بمنظم النمو بكس أعلى القيم كذلك تأثرت متانة الشلة معنويا بالمعاملات حيث أعطى التطويش فقط أعلى قيمة٠

Table (2): Effect of some agricultural and physiological treatments on final plant height, number of fruiting branches/plant, number of open bolls/plant, boll weight and number of plants/fed. at harvest in 1999 and 2000 seasons as well as their combined data.

Characters / Treatments	Final plant height, cm.			Number of fruiting branches/plant			Number of open bolls/plant			Boll weight, g.			Number of plants/fed. at harvest (thousand)		
Season	**1999**	**2000**	**Comb.**	**1999**	**2000**	**Comb.**	**1999**	**2000**	**Comb.**	**1999**	**2000**	**Comb.**	**1999**	**2000**	**Comb.**
1- Control (Untreated)	134	158.4	146.3	12.8	18.8	15.8	13.3	15.2	14.3	2.63	2.60	2.62	48.07	43.55	45.81
2- Pix, 30 g.a.i/fed., three times	110	127.3	118.9	13.2	14.9	14.1	14.4	19.0	16.7	2.63	2.69	2.66	50.47	43.20	46.87
3-Pix,30 g.a.i/fed.,once+topping at 100days from sowing	108	125	116.4	12.2	14.6	13.4	15.2	19.5	17.4	2.61	2.57	2.59	50.45	44.38	47.41
4- Topping at 100 days from sowing	116	122.4	119.4	12.4	14.6	13.5	14.2	14.8	14.5	2.68	2.71	2.69	46.52	45.45	45.98
5- PK foliar application, three times	127.7	152.3	139.9	14.4	17.7	16.1	12.8	14.9	13.9	2.49	2.68	2.59	47.55	44.73	46.01
6-Uniconazole,400g./fed.,three times	115	133.7	124.3	13.7	18.8	16.3	18.7	15.0	16.9	2.69	2.92	2.81	46.69	43.45	45.07
F- test	**	**	**	NS	**	**	**	**	**	NS	NS	NS	NS	NS	NS
N-L.S.D. 0.05	12.8	5.3	4.4	-	2.4	2.0	1.2	1.6	1.6	-	-	-	-	-	-

Table (3): Effect of some agricultural and physiological treatments on seed cotton yield/plant and /fed., lint % and seed index in 1999 and 2000 seasons as well as their combined data.

Characters / Treatments	Seed cotton Yield/plant, g.			Seed cotton Yield/fed., Kentar.			Lint %			Seed index, g.		
Season	1999	2000	Comb.	1999	2000	Comb.	1999	2000	Comb.	1999	2000	Comb.
1- Control (Untreated)	35.0	39.5	37.2	10.72	11.2	10.96	37.2	36.3	36.75	10.19	10.69	10.44
2- Pix, 30 g.a.i/fed., three times	37.9	51.1	44.4	11.91	14.2	13.05	36.9	37.0	36.95	10.38	10.57	10.47
3-Pix, 30 g.a.i/fed., once+topping at 100 days from sowing	39.7	50.0	44.8	12.53	13.7	13.11	37.0	36.9	36.95	10.76	10.39	10.57
4- Topping at 100 days from sowing	38.0	40.1	39.0	11.27	11.3	11.31	37.1	36.3	36.70	10.88	10.78	10.83
5- PK foliar application, three times	31.9	39.9	36.0	9.74	11.4	10.57	37.1	36.5	36.8	10.38	10.77	10.57
6- Uniconazole, 400 g./ fed., three times	50.3	43.8	47.0	14.92	12.2	13.56	37.8	36.2	37.0	9.78	10.64	10.21
F- test	**	**	**	**	**	**	*	NS	NS	**	NS	*
N-L.S.D. 0.05	3.0	7.4	3.6	0.95	0.88	0.53	0.63	-	-	0.45	-	0.34

Table (4): Effect of some agricultural and physiological treatments on some fiber properties in 1999 season.

Characters / Treatments	Fiber length			Fineness & Maturity			Yarn strength
	Fibrograph			F/M-T			Carded
	2.5% SL (mm)	50% SL (mm)	Uniformity ratio (%)	Micronaire Value	Fineness (millitex)	Maturity (%)	60'S Lea product
1- Control (Untreated)	31.7	15.9	50.2	3.7	140.7	77.0	2315.0
2- Pix, 30 g.a.i/fed., three times	31.3	15.5	49.5	4.2	155.0	85.0	2200.0
3- Pix, 30 g.a.i/fed., once + topping at 100 days from sowing	31.4	15.4	49.1	4.1	155.0	83.0	2167.7
4- Topping at 100 days from sowing	31.0	15.4	49.7	4.2	156.7	83.0	2410.0
5- PK foliar application, three times	31.0	15.7	50.6	4.1	152.7	81.5	2280.0
6- Uniconazole, 400 g./fed., three times	31.6	15.6	49.4	4.2	155.0	83.0	2192.8
F- test	NS	NS	NS	**	**	**	*
N-L.S.D. 0.05	-	-	-	0.1	2.0	0.8	153.4